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# ANNUAL FISH POPULATION SURVEYS
# OF
# LEWIS AND CLARK LAKE, 2002


South Dakota
Department of
Game, Fish and Parks
Wildlife Division
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# ANNUAL FISH POPULATION SURVEYS OF LEWIS AND CLARK LAKE, 2002

by
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Annual Report

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## Preface

Information collected from Lewis and Clark Lake during 1998-2002 is summarized in this report. Copies of this report and references to the data can be made with permission from the author or the Director of the Division of Wildlife, South Dakota Department of Game, Fish and Parks, 523 E. Capitol, Pierre, South Dakota 57501-3182.

The author would like to acknowledge the following individuals from South Dakota Game, Fish and Parks who helped with data collection, analysis, editing, and manuscript preparation: Jim Riis, Cliff Stone, John Lott, Robert Hanten, Wayne Nelson-Stastny, Jason Sorensen, Brian Beel, Cade Steffenson, Sylvester Schied, Andy Carda, John Wayne Kalda, Chris Mangus, Michael Bertrand, and Richard Crandall III; and from South Dakota State University Brian Graeb and Blake Davis. The collection of data for these surveys was funded, in part, by Federal Aid in Sport Fish Restoration, (D-J) project F-21-R, "Statewide Fish Management Surveys". Some of these data have been previously presented in segments F-30, 31, 32, 33, and 34 and in South Dakota Game, Fish and Parks Annual Report Number 01-17.

## Executive Summary

This report includes data from annual fish population surveys conducted during 1998-2002 for Lewis and Clark Lake and the Missouri River upstream and downstream of the reservoir. These surveys provide a means of evaluating management strategies contained in the Missouri River Fisheries Program strategic plan. Results and discussion in this report relate to changes in the fish community, population structure of sport fishes, angler use of the resource, and evaluation of management activities.

Seventeen species of age-0 fishes or small littoral fishes were sampled with seines in Lewis and Clark Lake in 2002. Emerald shiner had the highest catch per unit effort (CPUE), but declined almost tenfold from 2001. Age-0 gizzard shad and white bass were common in the catch. Age-0 walleye and sauger were present in seine samples, thus indicating that reproduction was successful by both species in 2002.

Twelve fish species were sampled with gill nets in Lewis and Clark Lake during 2002. Walleye and sauger dominated the catch, but CPUE for both species declined from 2001 Nearly all species suffered declines in CPUE from 2001 to 2002. However, common carp and shorthead redhorse had similar CPUE's for 2001 and 2002. Two species of interest were also collected. A small pallid sturgeon, suspected to have originated from an earlier stocking, was sampled for the first time since 1961 in Lewis and Clark Lake and since 1992 in the river above Lewis and Clark Lake. A paddlefish, a species of concern, was also collected in 2002.

The 2001 year-class dominated the walleye population in Lewis and Clark Lake. Walleye proportional stock density (PSD) decreased to 42, mean relative weight (Wr) decreased to the low 80's, and annual survival was estimated at 53%. The 2001 year-class was also most abundant in the sauger population. Sauger PSD decreased to 76, mean Wr decreased to the upper 70's, and annual survival was estimated at 57%. Channel catfish CPUE declined slightly from 2001, PSD increased to 70, and Wr's declined slightly to the mid-80's.

Lewis and Clark Lake flathead catfish CPUE was 36.0 fish/h during 2002, the highest documented. Mean Wr was 90, PSD was 18, and estimated annual survival was 55%.

Smallmouth bass CPUE in Lewis and Clark Lake near Gavins Point Dam increased to 75.0 fish/h in 2002, the highest documented. Mean Wr was 92, PSD increased to 49, and estimated annual survival was 44%. Catches of smallmouth bass in Gavins Point Dam tailwater increased to 51.0 fish/h. Mean Wr was 96, PSD dropped to 0, and estimated annual survival was 29%. Catch per unit effort of smallmouth bass in Ft. Randall Dam tailwater increased to 91.0 fish/h, while PSD decreased to 58. Mean Wr was 100 and annual survival was estimated at 66%.

Channel catfish CPUE, for baited hoop nets in the Missouri River near Springfield, SD during 2002, was 1.6 fish/net-night, the highest documented. Weighted mean length was 277 mm, the lowest documented. Mean Wr declined to 82, PSD declined to 22, and annual survival was estimated at 64%

Fourteen species of age-0 fishes or small prey fishes were collected with seines in the Missouri River near Springfield, SD in 2002. Largemouth bass was most abundant in the catch. Emerald shiner, Johnny darter, smallmouth bass, and river carpsucker were also common.

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# ANNUAL FISH POPULATION SURVEYS OF LEWIS AND CLARK LAKE, 2002

## INTRODUCTION

Lewis and Clark Lake provides a valuable fisheries resource for the state of South Dakota. This mainstem Missouri River reservoir spans over 10,000 hectares and annually supports over 100,000 hours of fishing activity (Stone 1985; Wickstrom 1995; Wickstrom 1996; Mestl et al. 2001; Wickstrom et al. 2002). The Lewis and Clark Lake fishery had an estimated worth of over $3.3 million in 2001 (Wickstrom et al. 2002). Lewis and Clark Lake is also important because the fishery is in an area with a relatively low density of quality fishing waters and is close to major population centers.

Because of the importance of this fishery, the fish community must be effectively managed to provide optimal recreational benefits while maintaining species diversity and protecting the native fish community. A prerequisite to development of effective management strategies is acquisition and analysis of data describing the fish community. This report contains data collected from Lewis and Clark Lake fish populations during 2002 and fish population surveys in the Missouri River upstream and downstream of Lewis and Clark Lake. These studies of the Missouri River and Lewis and Clark Lake fisheries are designed to fulfill strategies and evaluate objectives of the Missouri River Fisheries Program strategic plan (South Dakota Department of Game, Fish and Parks 1994).

A major change in harvest regulations went into effect in 2000. A year-round, 381 mm, minimum length limit was placed on walleye, sauger, and their hybrids in the Missouri River from Gavins Point Dam upstream to the South Dakota-Nebraska border below Ft. Randall Dam. The desired effect of the length limit was to extend the length of time that periodic, large year-classes of walleye and sauger would be available to anglers by restricting the harvest of small fish and their early removal from the population. Factors that indicated a size limit would be effective were low density of walleye and sauger, good growth rates, and excessive harvest of walleye and sauger at small sizes (Wickstrom 1995; Wickstrom 1996; Wickstrom 2000). This report continues to evaluate the effectiveness of the regulation change.

## OBJECTIVES

Objectives of annual fish population surveys are to provide information on:

1) species composition
2) relative abundance
3) age, growth, and condition
4) reproduction and recruitment
5) survival and mortality rates
6) population size structure
7) effects of regulations

8) effects of sportfish harvest.

Emphasis is given to important sport or prey species, as well as species that are threatened or endangered. Common and scientific names of fishes contained in this report are provided in Appendix 1.

## STUDY AREA

The study area is comprised of Lewis and Clark Lake, a reach of unchannelized Missouri River upstream of the reservoir, and Gavins Point Dam tailwater (Figure 1). Lewis and Clark Lake, formed by Gavins Point Dam, covers approximately 10,500 hectares and extends from near Yankton to Springfield, SD. The upstream river reach is approximately 60 km long and extends from Springfield to Ft. Randall Dam.

Lewis and Clark Lake has a maximum depth of 16.7 m and a mean depth of 5.0 m. The bottom is comprised of mud, silt, sand, and gravel. Water sources for the lake are the Missouri River and local tributaries entering the lake. The Niobrara River, which flows from the southwest, enters upstream of Lewis and Clark Lake near river mile (RM) 844 and is the major tributary between Ft. Randall and Gavins Point Dams. Management classification of Lewis and Clark Lake is cool and warm water permanent.

## METHODS

### LEWIS AND CLARK LAKE FISH COLLECTION

Variable-mesh gill nets and seines were used to sample fish populations in Lewis and Clark Lake. A variable-mesh gill net of multifilament nylon measured 91.4 m long by 1.8 m deep and contained 15.2 m panels of each of the following bar mesh sizes: 12.7 mm, 19.1 mm, 25.4 mm, 31.8 mm, 38.1 mm, and 50.8 mm. A total of twelve gill nets were fished overnight, approximately 20 hours, on the bottom in Lewis and Clark Lake during September 16-19, 2002. Three gill nets were fished in the 0-12 m stratum near the Bon Homme Colony (RM 824) and Tabor Access Area (RM 820), each (Figure 1). Three gill nets were fished near Gavins Point (RM 814) in the 0-12 m and 12-24 m strata, each (Figure 1). All fish collected with gill nets during 2002 were identified, counted, measured for total length, and weighed. Scales were collected from walleye and sauger below the lateral line near the distal end of the pectoral fin (Al-Absy and Carlander 1988).

A nylon 6.4 mm mesh bag seine, measuring 30.5 m long by 2.4 m deep with a 1.8 m by 1.8 m bag, was used to collect age-0 fishes and small littoral species. A quarter-arc seine haul was made using methods described by Martin et al. (1981). Two seine hauls were made at each site near Sand Creek (RM 828), Charlie Creek (RM 825), Bon Homme Colony (RM 822), and Gavins Point (RM 815), respectively on July 18, 2002 (Figure 1). All fish collected with seines were identified and counted.

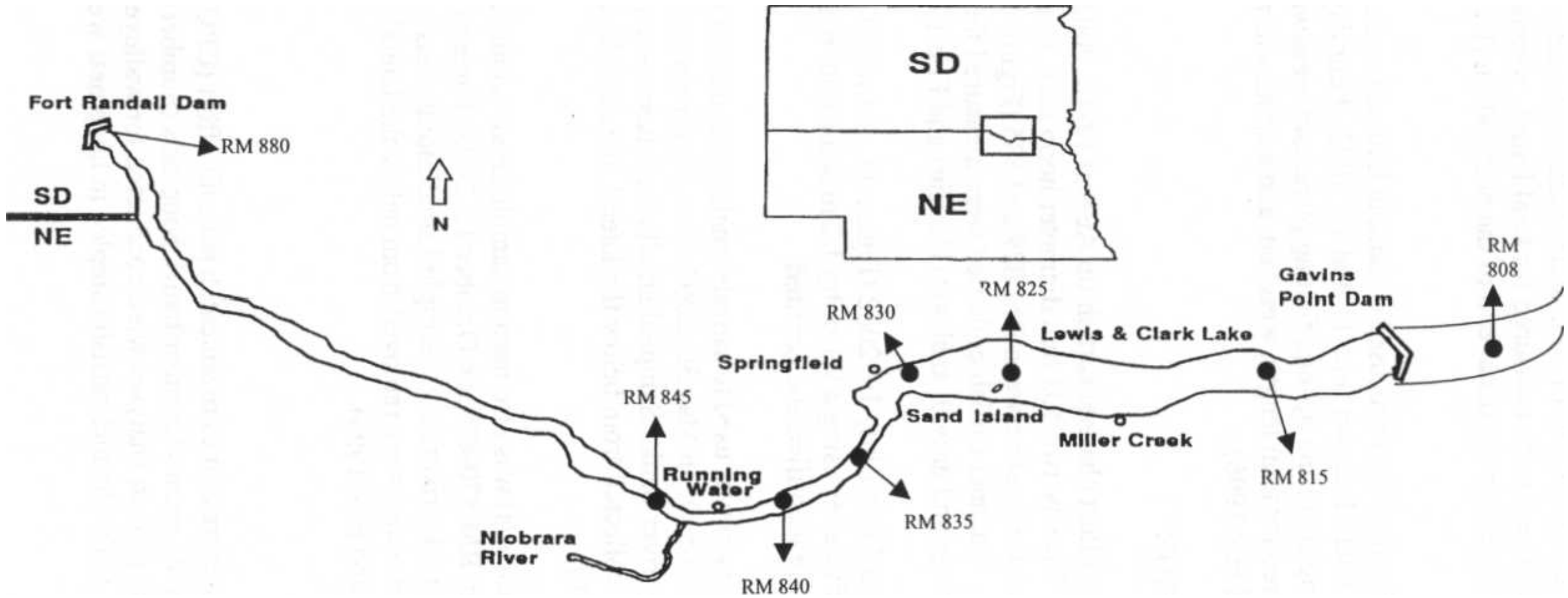


Figure 1. Lewis and Clark Lake and Missouri River study area from river mile (RM) 808 to 880.

Pulsed DC electrofishing (8 A, 60 pulses/s) was used to collect smallmouth bass along Gavins Point Dam on May 29, 2002. Three nighttime runs of 20 minutes each were made along rip-rapped shoreline. Sampled smallmouth bass were measured for total length, weighed, and scales were collected from below the lateral line near the distal end of the pectoral fin (Devries and Frie 1996) for age and growth analysis.

Pulsed DC electrofishing (2 amps, 15 pulses/sec) was used to sample flathead catfish along the south shore (Nebraska) of Lewis and Clark Lake on June 11 and 18, 2002. Four daytime runs of 15 to 20 minutes each were made along shoreline rip-rap, fishing piers, and breakwaters. Sampled flathead catfish were measured for total length, weighed, and a spine was removed for age and growth analysis (Devries and Frie 1996).

## MISSOURI RIVER FISH COLLECTION

Cheese-baited hoop nets were used to collect channel catfish on August 12-16, 2002 from the Missouri River near Springfield, SD. Twenty-two 508 mm diameter hoop nets, 11 each of 25 mm mesh and 38 mm mesh, were alternately set between RM 829 and 835 (Figure 1). Hoop nets were checked for fish every other day. Channel catfish collected were measured for total length, weighed and a spine was removed for age and growth analysis (DeVries and Frie 1996).

Seining was done between RM 829 and 835 on July 19, 2002 (Figure 1). A total of 20 quarter-arc seine hauls were made at five sites using a 9.1 m by 1.2 m seine with 6 mm nylon mesh. All fish sampled with seines were identified and counted.

Pulsed DC electrofishing (8 A, 60 pulses/s) was used to sample smallmouth bass in the Missouri River below Gavins Point Dam, RM 808-8 10, on May 30, 2002. Two daytime runs of 20 minutes each were made along a rocky river-bank. Sampled smallmouth bass were measured for total length, weighed, and scales were collected from below the lateral line near the distal end of the pectoral fin (DeVries and Frie 1996).

Pulsed DC electrofishing (7-8 A, 30 pulses/s) was also used to sample smallmouth bass in the Missouri River below Ft. Randall Dam, RM 870-875, on October 15, 2002. Three nighttime runs of 20 minutes each were made along a rocky riverbank. Sampled smallmouth bass were measured for total length, weighed, and scales were removed from below the lateral line near the distal end of the pectoral fin (DeVries and Frie 1996).

## DATA ANALYSIS

Relative abundance of fish species was expressed as mean catch per unit effort (CPUE) for variable-mesh gill nets (number/net-night), seines (number/haul), hoop nets (number/net-night), and electrofishing (number/h). Age and growth analyses were conducted for walleye, sauger, smallmouth bass, and flathead catfish. Only channel catfish sampled in hoop nets were analyzed for age and growth in 2002.

All suitable scale samples were aged and annuli measured with the aid of a microfiche reader (Jearld 1983). Subsamples of five catfish spines were aged when more than ten were collected per 10 mm length group. Otherwise, all spines collected were aged. Spines were sectioned to 0.6 mm thickness with an Isomet saw set on 6.5 speed using 75 g pressure. Sections were read with a binocular scope at 20 power. Back-calculations from scale and spine measurements were made using WinFin 2.95 (Francis 2000a) and WinFin Analysis (Francis 2000b) computer programs. Standard Y-intercept values suggested by Carlander (1982) were used for walleye (55 mm), sauger (55 mm), smallmouth bass (35 mm), channel catfish (30 mm), and flathead catfish (30 mm). Age distributions were developed by assigning ages to all fish sampled with gill nets, hoop nets, trap nets, or electrofishing.

Proportional stock density (PSD; Anderson and Weithman 1978) and relative stock density (RSD) values were calculated for walleye, sauger, channel catfish, smallmouth bass, flathead catfish, freshwater drum, gizzard shad, and river carpsucker. Length categories used to calculate PSD and RSD are provided in Table 1 (Anderson and Neumann 1996; Bister et al. 1999).

Table 1. Minimum total lengths (mm) for length class designations.

| Species | **Stock** | Quality | **Preferred** | Memorable |
|---|---|---|---|---|
| Walleye | 250 | 380 | 510 | 630 |
| Sauger | 200 | 300 | 380 | 510 |
| Smallmouth bass | 180 | 280 | 350 | 430 |
| Channel catfish | 280 | 410 | 610 | 710 |
| Flathead catfish | 280 | 410 | 610 | 710 |
| Freshwater drum | 200 | 300 | 380 | 510 |
| River carpsucker | 180 | 280 | 360 | 460 |
| Gizzard shad | 180 | 280 | | |

* not established

Relative weights (*Wr;* Anderson 1980) were calculated for length categories using standard weight equations for walleye, sauger, channel catfish, and smallmouth bass provided by Anderson and Neumann (1996). The flathead catfish standard weight equation was provided by Murphy et al. (1991). Standard weight equations for freshwater drum, gizzard shad, and river carpsucker were provided by Bister et al. (1999). Standard weight equations used in this report are provided in Appendix 2.

Length-weight regression equations were developed for walleye, sauger, channel catfish, flathead catfish, and smallmouth bass using Systat 8.0 (SPSS 1998). The equations are presented in Appendix 3.

Survival and mortality estimates were calculated using catch curves (Ricker 1975). The age that fish were first fully susceptible to the sampling gear was coded as "1", the second as "2", and so forth. Two or more consecutive years of age distribution data were combined for analysis, when available, to reduce the effects of variable recruitment.

# RESULTS AND DISCUSSION

## LEWIS AND CLARK LAKE-SEINES

Seventeen species of age-0, or small littoral species, were sampled with seines during 2002 (Table 2). All species have been previously sampled from Lewis and Clark Lake (Wickstrom 2002). Emerald shiner and white bass CPUE declined almost tenfold from 2001. Catches of yellow perch, white bass, spottail shiner, and spotfin shiner were the lowest of the five-year period. Age-0 gizzard shad, smallmouth bass, walleye, and black and white crappie catches increased over 2001. Age-0 sauger catch was similar to 2001 and age-0 largemouth bass catch declined from 2001. Bigmouth buffalo was last sampled with seines in 1996 (Wickstrom 1998).

## LEWIS AND CLARK LAKE-GILL NETS

### Species Composition and Relative Abundance

Gill nets sampled 12 species of fish in Lewis and Clark Lake during 2002 (Table 3). All species have been previously reported (Walburg 1976; Wickstrom 1998; Wickstrom 2001). Paddlefish was last captured during this survey in 1994 (Wickstrom 1995). Gizzard shad, freshwater drum, channel catfish, sauger, and walleye were common in the catch (Figure 2). Channel catfish CPUE decreased in 2002 and was the lowest of the five-year period. Freshwater drum, river carpsucker, and white crappie CPUE declined after large increases in 2001. Shortnose gar was not sampled in 2002, the first time since 1996 that none was observed in the catch (Wickstrom 1997). Population indices for freshwater drum, gizzard shad, and river carpsucker are provided in Appendix 4.

Both sauger and walleye catches declined from 2001. Gill net catches of sauger 380 mm (15 inches) and longer averaged 4.5 fish/ net-night, compared to 4.8 fish/net-night in 2001 and 2.0 fish/net-night in 2000. Mean CPUE of walleye 380 mm and longer was 2.7 fish/net-night, compared to 3.5 fish/net-night in 2001 and 1.5 fish/net-night in 2000. Thus, catches of both walleye and sauger longer than 380 mm were lower than last year but higher than two years ago.

One pallid sturgeon, approximately 225 mm fork length, was captured in the upper portion of Lewis and Clark Lake near the Bon Homme Colony (RM 824). The fish appeared to be in excellent condition and was immediately returned to the water. This fish is suspected to have originated from a pallid sturgeon stocking that recently occurred in the Missouri River upstream of Lewis and Clark Lake in an attempt to rebuild native populations (Personal communication, Wayne Stancill, United States Fish and Wildlife Service). A pallid sturgeon was last captured from Lewis and Clark Lake in 1961 (Walburg 1964). However, Stastny (1994) reported sampling a pallid sturgeon from the Missouri River near Running Water, SD in 1992.

Table 2. Mean catch per seine haul, sampling stations combined, of age-0 and small littoral fishes from Lewis and Clark Lake, 1998-2002 standard error .

| Species | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|
| Bigmouth buffalo | 0.0 | 0.0 | 0.0 | 0.0 | 0.1(0.1) |
| Black crappie | 0.0 | 1.9(1.5) | 0.0 | 0.0 | 0.5(0.3) |
| Bluegill | 1.8(0.6) | 0.0 | 0.0 | 0.3(0.2) | 0.1(0.1) |
| Bluntnose minnow | 0.0 | 0.0 | 0.0 | 0.1(0.1) | 0.0 |
| Brassy minnow* | 0.4(0.4) | 0.0 | 0.0 | 0.0 | 0.0 |
| Common carp | 0.5(0.3) | 0.0 | 0.0 | 0.6(0.4) | 0.0 |
| Common shiner | 0.0 | 0.0 | 0.0 | 0.3(0.2) | 0.0 |
| Creek Chub | 0.0 | 0.0 | 0.0 | 0.8(0.5) | 0.0 |
| Emerald shiner* | 79.4(52.3) | 348.8(181.3) | 214.4(85.1) | 1399.8(1807.9) | 189.9(72.2) |
| Fathead minnow* | 0.0 | 0.0 | 0.1(0.1) | 0.0 | 0.0 |
| Freshwater drum | 9.1(3.2) | 0.0 | 6.5(3.1) | 3.8(1.7) | 2.1(1.5) |
| Gizzard shad | 12.0(9.8) | 58.3(33.3) | 125.9(82.7) | 5.5(3.7) | 16.6(14.6) |
| Grass pickerel | 0.3(0.2) | 0.0 | 0.0 | 0.0 | 0.0 |
| Golden shiner | 0.0 | 0.0 | 0.0 | 0.1(0.1) | 0.0 |
| Johnny darter* | 1.5(1.0) | 5.1(2.1) | 6.1(3.7) | 0.5(0.3) | 0.5(0.2) |
| Largemouth bass | 6.0(3.5) | 2.1(0.7) | 0.4(0.2) | 1.3(0.5) | 0.5(0.5) |
| Northern redhorse | 0.0 | 0.1(0.1) | 0.0 | 0.1(0.1) | 0.0 |
| Rainbow smelt | 0.0 | 0.0 | 0.0 | 0.1(0.1) | 0.0 |
| Red shiner* | 1.3(1.0) | 0.1(0.1) | 0.3(0.2) | 0.4(0.4) | 0.0 |
| River carpsucker | 0.1(0.1) | 0.0 | 0.3(0.2) | 0.3(0.2) | 0.4(0.2) |
| Sauger | 0.6(0.3) | 0.8(0.5) | 0.0 | 0.4(0.2) | 0.4(0.2) |
| Silver chub* | 0.0 | 0.0 | 0.1(0.1) | 0.1(0.1) | 0.0 |
| Shortnose gar | 0.1(0.1) | 0.1(0.1) | 0.0 | 0.0 | 0.0 |
| Smallmouth bass | 0.1(0.1) | 2.0(0.7) | 2.4(0.6) | 0.6(0.3) | 1.1(0.6) |
| Smallmouth buffalo | 4.0(1.5) | 0.0 | 0.0 | 0.4(0.2) | 0.0 |
| Spotfin shiner* | 1.4(1.4) | 1.5(1.0) | 2.0(1.6) | 8.9(2.9) | 0.1(0.1) |
| Spottail shiner* | 2.8(2.3) | 4.1(3.9) | 3.6(2.1) | 30.5(24.4) | 2.5(1.8) |
| Walleye | 2.9(0.7) | 3.6(1.6) | 2.1(1.2) | 1.5(1.1) | 3.0(1.2) |
| White bass | 25.3(10.3) | 250.6(133.7) | 64.3(32.4) | 90.5(46.8) | 14.5(9.8) |
| White crappie | 8.4(2.0) | 6.3(3.0) | 0.5(0.4) | 0.0 | 1.0(1.0) |
| Yellow perch | 28.6(15.9) | 1.4(1.2) | 3.8(1.8) | 22.1(16.3) | 1.0(0.7) |
| Cyprinidae larvae | 0.0 | 0.0 | 0.4(0.4) | 0.0 | 0.0 |

* includes both age-0 and adult fish

Table 3. Mean ill net catch per lift, sampling stations combined, for Lewis and Clark Lake, 1998-2002 standard error).

| Species | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|
| Bigmouth buffalo | 0.3(0.1) | 0.2(0.2) | 0.0 | 0.0 | 0.0 |
| Channel catfish | 3.6(0.9) | 3.8(1.3) | 3.9(0.5) | 4.7(1.3) | 3.3(0.8) |
| Common carp | 0.3(0.2) | 0.3(0.1) | 0.1(0.1) | 0.3(0.1) | 0.5(0.2) |
| Emerald shiner | 0.0 | 0.1(0.1) | 0.0 | 0.0 | 0.0 |
| Freshwater drum | 9.3(1.8) | 3.3(1.1) | 8.2(1.4) | 24.6(8.6) | 5.0(1.4) |
| Gizzard shad | 4.9(1.6) | 1.1(0.4) | 17.1(4.1) | 13.6(4.8) | 5.5(2.0) |
| Goldeye | 0.1(0.1) | 0.0 | 0.0 | 0.0 | 0.0 |
| Paddlefish | 0.0 | 0.0 | 0.0 | 0.0 | 0.1(0.1) |
| Pallid sturgeon | 0.0 | 0.0 | 0.0 | 0.0 | 0.1(0.1) |
| River carpsucker | 5.3(1.7) | 3.0(0.9) | 1.7(0.7) | 7.3(2.0) | 1.6(0.8) |
| Rock bass | 0.1(0.1) | 0.0 | 0.0 | 0.0 | 0.0 |
| Sauger | 7.3(1.3) | 6.0(0.9) | 6.0(1.5) | 13.5(1.4) | 8.9(1.1) |
| Shorthead redhorse | 0.0 | 0.1(0.1) | 0.3(0.2) | 0.2(0.1) | 0.3(0.2) |
| Shortnose gar | 0.4(0.3) | 0.3(0.2) | 0.6(0.2) | 0.9(0.5) | 0.0 |
| Smallmouth buffalo | 0.0 | 0.4(0.3) | 0.1(0.1) | 0.3 (0.2) | 0.0 |
| Spottail shiner | 0.0 | 0.1(0.1) | 0.0 | 0.1(0.1) | 0.0 |
| Walleye | 4.7(1.3) | 3.8(1.0) | 5.2(1.3) | 11.9(2.5) | 8.3(1.3) |
| White bass | 0.0 | 0.0 | 0.1(0.1) | 0.4(0.3) | 0.2(0.2) |
| White crappie | 3.3(2.5) | 0.8(0.4) | 0.6(0.3) | 2.9(1.5) | 1.8(1.2) |
| Yellow perch | 0.3(0.2) | 0.1(0.1) | 0.0 | 0.1(0.1) | 0.0 |

**Others includes:**
**Common carp**
**Paddlefish**
**Pallid sturgeon**
**Shorthead redhorse**
**White bass**

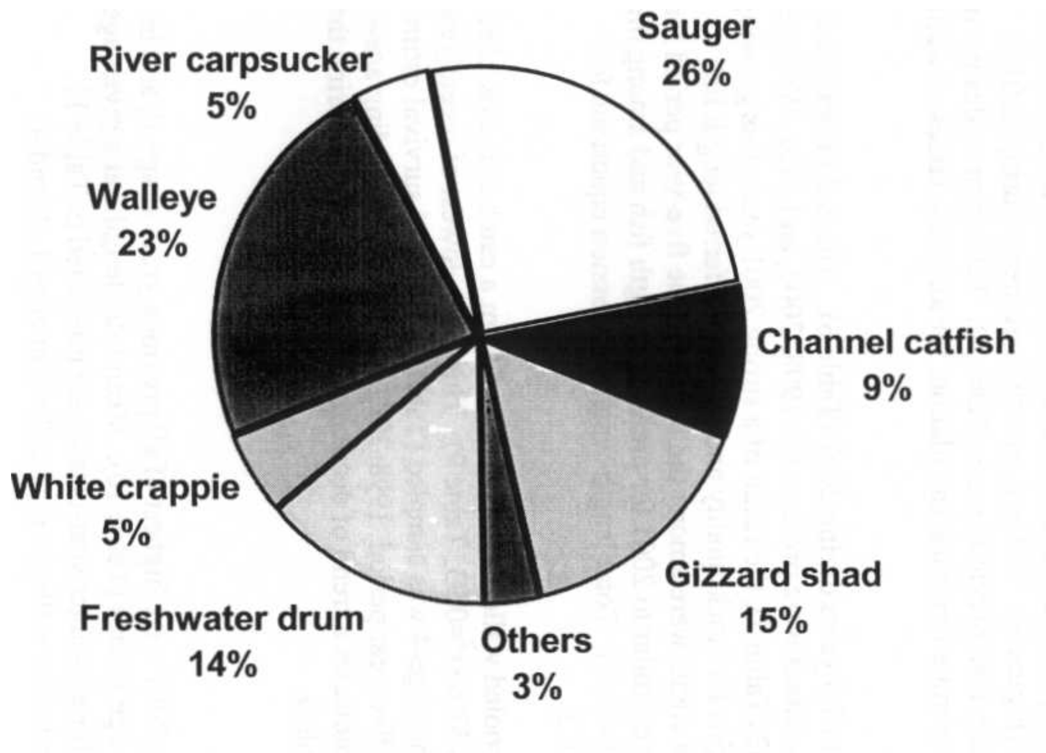


Figure 2. Fish species composition, by percent of total, from Lewis and Clark Lake gill net catches during September 2002.

Walleye Population Parameters

Five age-groups of walleye were represented in the 2002 gill net sample and ranged in total length from 132 mm to 560 mm (Figure 3). Walleye growth increments during 2001 in Lewis and Clark Lake were greater than previous years (Table 4). Table 5 provides the mean total length at a given age, as determined by back-calculation, for all year-classes of walleye sampled in 2002.

Mean age of walleye decreased to 1.8 years during 2002 (Table 6). Age and growth analysis revealed that large walleye year-classes were produced in 1998, 2000, and 2001. Walleye PSD decreased to 42 during 2002 (Table 7), the result of a strong 2001 year-class growing past stock length. Relative weights for stock-quality and quality-preferred length fish decreased from 2001. Relative weights were among the lowest of the five-year period for stock-quality length fish, but were similar to 2001 for preferred-length fish and among the highest of the five-year period (Table 8). Total length-weight regression equations for walleye are supplied in Appendix 3.

Annual survival for 2001-2002 pooled walleye data estimated from a catch curve (Ricker 1975), excluding age-0 fish, was 53% ($r^2$=0.93; Table 9). This is the lowest of recent years, probably because no fish older than age-4 was sampled (Table 6). Annual survival estimated from a catch curve for the entire five-year period, 1998-2002 pooled data excluding age-0 fish, was 59% ($r^2$=0.94), which indicates a trend of decreasing walleye survival during the past five years as depicted in Table 9.

Sauger Population Parameters

Sauger growth increments during 2001 were highest of all previous years at age-0, and in the range of previous years for older age groups (Table 10). Mean total lengths at a given age, as determined by back-calculation, for all sauger year-classes are presented in Table 11. Saugers were shorter in total length than walleyes during 2001 at ages 1, 3, and 4.

Mean age of sauger sampled from Lewis and Clark Lake in 2002 decreased to 2.4 years (Table 12). Age and growth analysis revealed that large year-classes were produced in 1998, 2000, and 2001, similar to walleye (Table 6). Eight age-groups were represented in the sample and ranged in total length from 134 mm to 539 mm (Figure 4). Sauger PSD decreased to 76 in 2002 (Table 7), the result of a large 2001 year-class growing past stock length. Mean Wr values decreased for quality-preferred length fish from 2001, but were not unlike 2001 for stock-quality and preferred length fish (Table 8). Total length-weight regression equations for sauger are provided in Appendix 3.

Annual survival for 2001-2002 pooled sauger data was 57% (Table 9), as estimated from catch curve analysis ($r^2$=0.90; Ricker 1975) excluding age-0 fish. Annual survival decreased from that estimated for 2000-2001 pooled data and was the lowest of recent years. However, annual survival estimated from a catch curve for the five-year period, 1998-2002 pooled data excluding age-0 fish, was 53% ($r^2$=0.83), which was lower than survival estimated for any given period of years in Table 9.

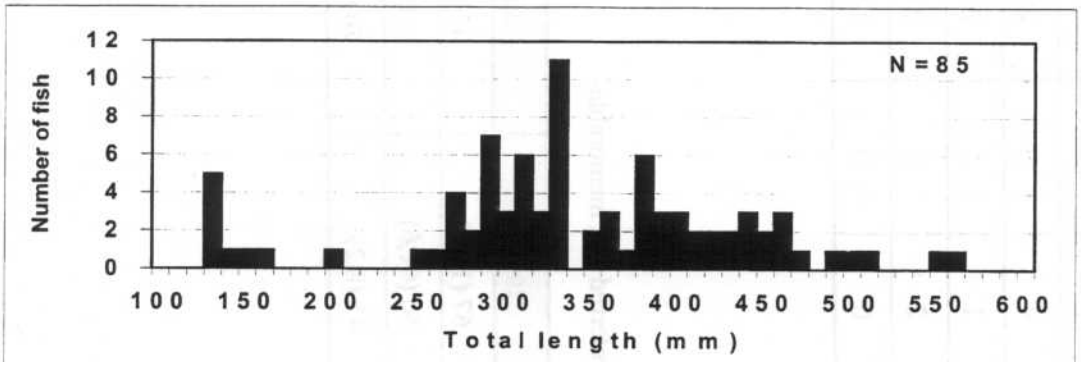


Figure 3. Length frequency of walleye collected with gill nets from Lewis and Clark Lake during September 2002. N is the sample size.

Table 4. Mean annual growth increments (mm) of back-calculated total lengths for each year-class of walleye collected with gill nets from Lewis and Clark Lake in 20€

| Year | | | Growth period (ages) | | | |
|---|---|---|---|---|---|---|
| class | Age | N | 0-1 | 1-2 | 2-3 | 3-4 |
| 2001 | 1 | 39 | 188 | | | |
| 2000 | 2 | 21 | 154 | 177 | | |
| 1999 | 3 | 5 | 164 | 144 | 114 | |
| 1998 | 4 | 11 | 168 | 130 | 88 | 66 |
| Population mean | | | 169 | 150 | 101 | 66 |
| Sample size | | 76 | 76 | 37 | 16 | 11 |

Table 5. Mean back-calculated total lengths (mm) for each year-class of walleye collected with gill nets from Lewis and Clark Lake, 2002.

| Year | | | Back-calculation age | | | |
|---|---|---|---|---|---|---|
| class | Age | N | 1 | 2 | 3 | 4 |
| 2001 | 1 | 39 | 188 | | | |
| 2000 | 2 | 21 | 154 | 331 | | |
| 1999 | 3 | 5 | 164 | 308 | 422 | |
| 1998 | 4 | 11 | 166 | 296 | 384 | 450 |
| Population mean | | | 168 | 311 | 403 | 450 |
| Sample size | | 76 | 76 | 37 | 16 | 11 |

Table 6. Age distribution of walleye collected with gill nets from Lewis and Clark Lake, 1998-2002. Mean age excludes a e-0 fish.

| Year | Age | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **0** | 1 | **2** | **3** | **4** | **5** | **6** | **7** | **Mean** |
| 1998 | 44 | 4 | 1 | 2 | 0 | 2 | 3 | 0 | 3.3 |
| 1999 | 5 | 23 | 4 | 5 | 2 | 2 | 4 | 0 | 2.2 |
| 2000 | 16 | **11** | 27 | 3 | 2 | 0 | 1 | 2 | 2.2 |
| 2001 | 79 | 18 | 10 | 26 | 2 | 3 | 2 | 2 | 2.6 |
| 2002 | 9 | 39 | 21 | 5 | **11** | 0 | 0 | 0 | 1.8 |

Table 7. Walleye, sauger, and channel catfish proportional stock density (relative stock density of preferred and memorable-length fish from Lewis and Clark Lake ill net catches, 1998-2002.

| Species | 1998 | 1999 | **2000** | **2001** | **2002** |
|---|---|---|---|---|---|
| Walleye | 83 (17,0) | 62(8,0) | 40(7,0) | 67 (10,0) | 42(4,0) |
| Sauger | 88 (52,0) | 87 (60,1) | 80 (42,5) | 86 (61,6) | 76 (53,3) |
| Channel catfish | 30(3,0) | 31 (12,0) | 47(5,2) | 43(8,2) | 70(3,0) |

Table 8. Mean relative weight, by length category, for Lewis and Clark Lake walleye, sauger, and channel catfish collected with gill nets. N is the number of stock-length fish. Standard errors are in parenthesis.

| **Year** | **Stock-quality** | **Quality-preferred** | **Preferred** | **N** |
|---|---|---|---|---|
| Walleye | | | | |
| 1998 | 91(0.7) | 86(2.0) | 84(5.4) | 12 |
| 1999 | 86(0.6) | 85(2.4) | 81(0.4) | 39 |
| 2000 | 81(0.2) | 78(0.3) | 79(1.5) | 45 |
| 2001 | 85(0.6) | 87(0.5) | 85(0.9) | 63 |
| 2002 | 80(0.4) | 81(0.7) | 84(1.0) | 76 |
| **Sauger** | | | | |
| 1998 | 83(2.8) | 80(1.1) | 79(1.0) | 48 |
| 1999 | 78(1.5) | 79(1.2) | 77(0.7) | 70 |
| 2000 | 77(1.0) | 80(0.7) | 75(2.0) | 57 |
| 2001 | 80(0.7) | 84(0.8) | 80(0.6) | 95 |
| 2002 | 77(0.8) | 78(0.5) | 79(0.7) | 102 |
| **Channel catfish** | | | | |
| 1998 | 83(0.9) | 85(3.2) | 101(0.0) | 30 |
| 1999 | 84(0.8) | 82(1.3) | 93(2.9) | 42 |
| 2000 | 87(0.8) | 86(1.1) | 80(5.4) | 43 |
| 2001 | 87(0.6) | 86(1.4) | 89(7.4) | 53 |
| 2002 | 85(1.7) | 85(1.4) | 84(0.0) | 33 |

Table 9. Catch curve estimates of annual survival (S), annual mortality (A), instantaneous mortality rates (-Z), and coefficient of determination (r) for age-1 and older fish. Years indicate which annual ill net survey s were combined for analy sis.

| **Species** | **Years** | **S** | **A** | **-Z** | **$r^2$** |
|---|---|---|---|---|---|
| Walleye | 1997-1998 | 0.75 | 0.25 | 0.287 | 0.70 |
| | 1998-1999 | 0.78 | 0.22 | 0.248 | 0.29 |
| | 1999-2000 | 0.62 | 0.38 | 0.483 | 0.79 |
| | 2000-2001 | 0.62 | 0.38 | 0.473 | 0.74 |
| | 2001-2002 | 0.53 | 0.47 | 0.638 | 0.93 |
| Sauger | 1997-1998 | 0.60 | 0.40 | 0.512 | 0.68 |
| | 1998-1999 | 0.69 | 0.31 | 0.375 | 0.60 |
| | 1999-2000 | 0.61 | 0.39 | 0.496 | 0.66 |
| | 2000-2001 | 0.64 | 0.36 | 0.453 | 0.75 |
| | 2001-2002 | 0.57 | 0.43 | 0.570 | 0.90 |
| Channel catfish | 2000 | 0.78 | 0.22 | 0.254 | 0.56 |
| | 2000-2001 | 0.74 | 0.26 | 0.295 | 0.77 |

Table 10. Mean annual growth increments (mm) of back-calculated total lengths for each year-class of sauger collected with gillnets from Lewis and Clark Lake in 2002.

| Year class | Age | N | Growth period (ages) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **0-1** | **1-2** | **2-3** | **3-4** | **4-5** | **5-6** | **6-7** |
| 2001 | 1 | 34 | 185 | | | | | | |
| 2000 | 2 | 32 | 155 | 185 | | | | | |
| 1999 | 3 | 6 | 171 | 151 | 82 | | | | |
| 1998 | 4 | 23 | 174 | 141 | 65 | 46 | | | |
| 1997 | 5 | 4 | 165 | 141 | 58 | 40 | 32 | | |
| 1996 | 6 | 1 | 170 | 163 | 121 | 27 | 13 | 9 | |
| 1995 | 7 | 2 | 153 | 200 | 40 | 39 | 35 | 31 | 17 |
| Population mean | | | 168 | 164 | 73 | 38 | 27 | 20 | 17 |
| Sample size | | 102 | 102 | 68 | 36 | 30 | 7 | 3 | 2 |

Table 11. Mean back-calculated total lengths (mm) at annulus for each year-class of sauger collected with gillnets from Lewis and Clark Lake in 2002.

| Year class | Age | N | Back-calculation age | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | **3** | **4** | **5** | 6 | 7 |
| 2001 | 1 | 34 | 185 | | | | | | |
| 2000 | 2 | 32 | 155 | 340 | | | | | |
| 1999 | 3 | 6 | 171 | 322 | 404 | | | | |
| 1998 | 4 | 23 | 174 | 314 | 379 | 425 | | | |
| 1997 | 5 | 4 | **165** | 306 | 364 | 404 | 436 | | |
| 1996 | 6 | 1 | 170 | 333 | 454 | 481 | 494 | 503 | |
| 1995 | 7 | 2 | 153 | 353 | 393 | 432 | 467 | 498 | 515 |
| Population mean | | | 167 | 328 | 399 | 435 | 466 | 501 | 515 |
| Sample size | | 102 | 102 | 68 | 36 | 30 | 7 | 3 | 2 |

Table 12. Age distribution of sauger collected with gill nets from Lewis and Clark Lake, 1998-2002. Mean a e excludes a e-0 fish.

| Year | Age | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **0** | 1 | **2** | **3** | **4** | **5** | **6** | | **Mean** |
| 1998 | 43 | 8 | 16 | 5 | 8 | 7 | 1 | 0 | 2.8 |
| 1999 | 2 | 10 | 19 | 21 | 16 | 2 | 2 | 0 | 2.8 |
| 2000 | 15 | 12 | 18 | 14 | 8 | 5 | 0 | 0 | 2.6 |
| 2001 | 78 | 21 | 17 | 27 | 9 | 8 | 3 | 0 | 2.7 |
| 2002 | 5 | 34 | 32 | 6 | 23 | 4 | 1 | 2 | 2.4 |

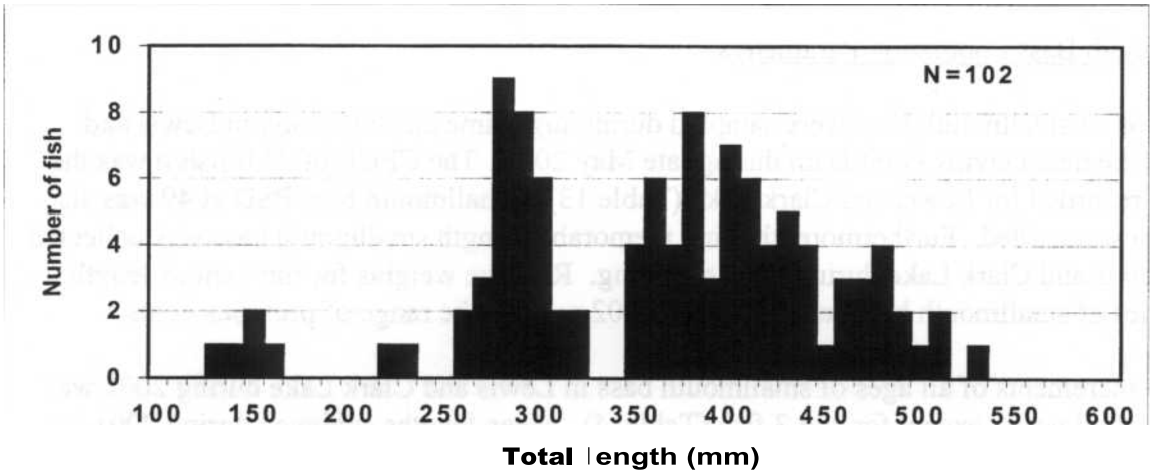


Figure 4. Length frequency of sauger collected with gill nets from Lewis and Clark Lake during September 2002. N is the sample size.

Channel Catfish Population Parameters

Channel catfish gill net CPUE in Lewis and Clark Lake during 2002 declined from a five-year high in 2001 to the lowest of the five-year period (Table 3). Total length ranged from 254 mm to 770 mm (Figure 5), and PSD increased to 70 in 2002 (Table 7). Mean relative weights were in the range of previous years (Table 8). Total length-weight regression equations are provided in Appendix 3. Estimated annual survival rates for previous years are presented in Table 9.

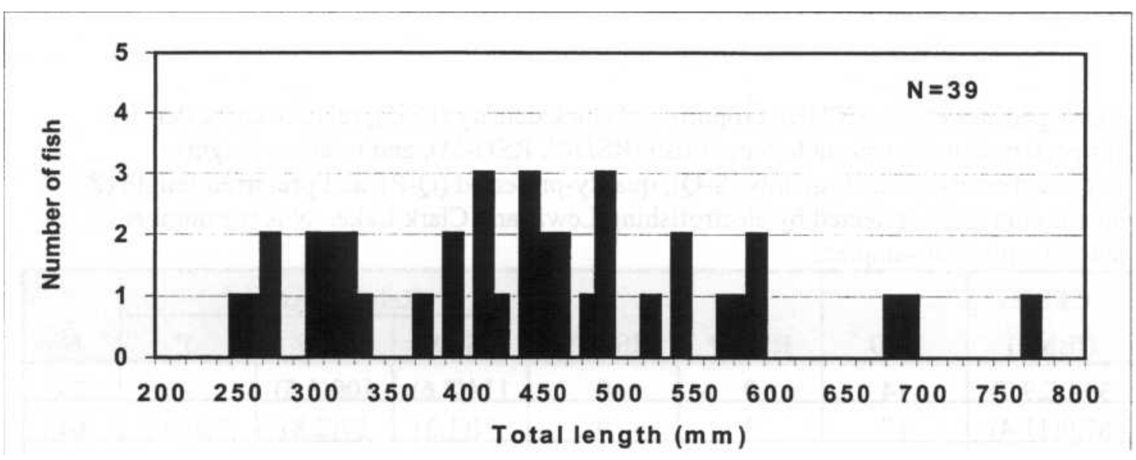


Figure 5. Length frequency of channel catfish collected with gill nets from Lewis and Clark Lake during September 2002. N is the sample size.

LEWIS AND CLARK LAKE -ELECTROFISHING

Smallmouth Bass Population Parameters

A total of 75 smallmouth bass were sampled during nighttime electrofishing in Lewis and Clark Lake near Gavins Point Dam during late May 2002. The CPUE of 75.0 fish/h was the highest recorded for Lewis and Clark Lake (Table 13). Smallmouth bass PSD at 49 was also the highest recorded. Furthermore, the first memorable-length smallmouth bass was collected from Lewis and Clark Lake during 2002 sampling. Relative weights for the various length categories of smallmouth bass sample during 2002 were in the range of previous years.

Growth increments of all ages of smallmouth bass in Lewis and Clark Lake during 2001 was highest of all years, except for age-3 fish (Table 14). Mean lengths achieved during 2001, as determined by back-calculation, were greater for all fish at each age than any previous year (Table 15). Population mean total lengths were longer than means reported by Willis et al. (2001) for statewide South Dakota waters and Missouri River reservoirs. Age and growth analysis revealed that fish of the 1999 year-class were most abundant in the 2002 sample, similar to 2000 and 2001, and that six age-groups were represented in the sample (Table 16). Mean age increased to 2.9 years and was the highest of the five-year period. Smallmouth bass along Gavins Point Dam ranged in length from 131 mm to 476 mm (Figure 6). Total length-weight regression equations are provided in Appendix 3.

Smallmouth bass annual survival estimated from catch curve analysis (Ricker 1975) for 2001 and 2002 pooled data, using age-2 and older fish numbers, was 44% with an $r^2$ value of 0.80. Annual survival estimated for 2000-2001 data, from catch curve analysis using age-2 and older fish numbers, was also 44% with an $r^2$ value of 0.91. This later figure differs from the estimate provided by Wickstrom (2002) for 2000-2001 pooled data, for age-1 and older fish, of 67% with an $r^2$ value of 0.32. Apparently age-1 smallmouth bass were not fully susceptible to electrofishing and were not sampled in relation to their abundance in the population, which caused annual survival to be overstated.

Table 13. Catch per unit effort (CPUE), proportional stock density (PSD), relative stock density for preferred and memorable-length fish (RSD-P, RSD-M), and relative weights (standard error) of stock-quality (S-Q), quality-preferred (Q-P), and preferred-length (P) smallmouth bass collected by electrofishing Lewis and Clark Lake. N is the number of stock-length fish sampled.

| Year | CPUE fish/h | PSD | RSD-P | RSD-M | Relative weight | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 0 | P | |
| '': | NE-215 | | 1 | | Mr, | 1 | - | |
| 1999 | 67.0 11.4 | 17 | 3 | 0 | 91 1.3 | 872.8 | 81 6.0 | 64 |
| 2000 | 21.0 6.9 | 39 | 17 | 0 | 97 1.6 | 91 2.2 | 920.0 | 18 |
| 2001 | 59.0 9.5 | 17 | 4 | 0 | 940.5 | 840.6 | 87 5.6 | 54 |
| 2002 | 75.0 12.5 | 49 | 11 | 3 | 920.9 | 88 0.9 | 932.5 | 70 |

Table 14. Mean annual growth increments (mm) of back-calculated total lengths for each year-class of smallmouth bass collected by electrofishing Lewis and Clark Lake near Gavins Point Dam during May 2002.

| Year class | Age | N | Growth period (ages) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 |
| 2001 | 1 | 2 | 135 | | | | | |
| 2000 | 2 | 28 | 101 | 113 | | | | |
| 1999 | 3 | 32 | 100 | 103 | 94 | | | |
| 1998 | 4 | 5 | 100 | 103 | 84 | 63 | | |
| 1997 | 5 | 1 | 76 | 80 | 77 | 69 | 76 | |
| 1996 | 6 | 5 | 89 | 96 | 84 | 55 | 32 | 35 |
| Population mean | | | 100 | 99 | 85 | 62 | 54 | 35 |
| Sample size | | 73 | 73 | 71 | 43 | 11 | 6 | 5 |

Table 15. Mean back-calculated total lengths (mm) at annulus for each year-class of smallmouth bass collected b electrofishing Lewis and Clark Lake near Gavins Point Dam during May 2002.

| Year class | Age | N | Back-calculation age | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| 2001 | 1 | 2 | 135 | | | | | |
| 2000 | 2 | 28 | 101 | 214 | | | | |
| 1999 | 3 | 32 | 100 | 203 | 297 | | | |
| 1998 | 4 | 5 | 100 | 203 | 287 | 350 | | |
| 1997 | 5 | 1 | 76 | 156 | 233 | 302 | 378 | |
| 1996 | 6 | 5 | 89 | 185 | 269 | 324 | 356 | 391 |
| Population mean | | | 100 | 192 | 272 | 325 | 367 | 391 |
| Sample size | | 73 | 73 | 71 | 43 | 11 | 6 | 5 |

Table 16. Age distribution of smallmouth bass collected by electrofishing Lewis and Clark Lake near Gavins Point Dam, 1998-2002.

| Year | Age | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | Mean |
| 1998 | 9 | 18 | 7 | 3 | 1 | 0 | 2.2 |
| 1999 | 3 | 38 | 18 | 6 | 2 | 0 | 2.5 |
| 2000 | 2 | 8 | 6 | 2 | 1 | 2 | 2.9 |
| 2001 | 4 | 45 | 4 | 5 | 1 | 0 | 2.2 |
| 2002 | 2 | 29 | 33 | 5 | 1 | 5 | 2.9 |

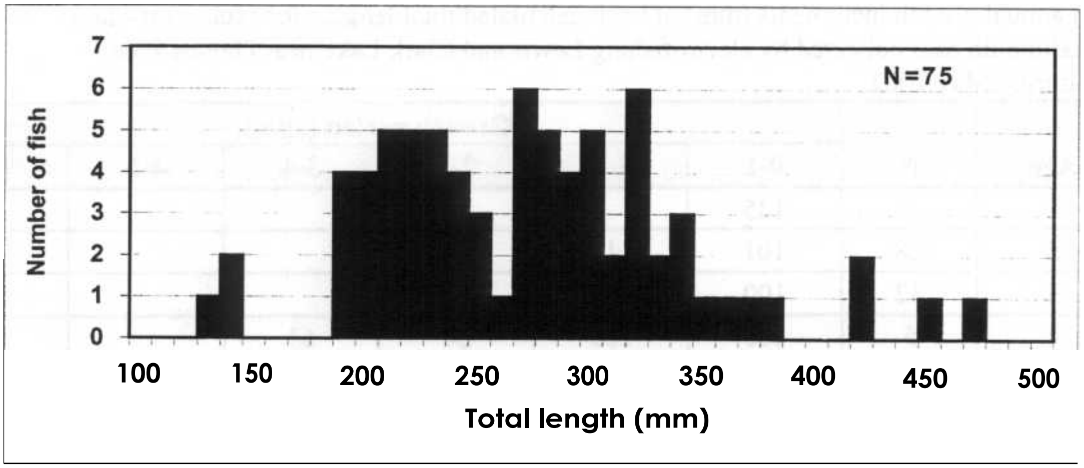

Figure 6. Length frequency of smallmouth bass collected by electrofishing Lewis and Clark Lake near Gavins Point Dam during May 2002. N is the sample size.

Flathead Catfish Population Parameters

Daytime electrofishing along the south shoreline of Lewis and Clark Lake during 2002 produced a total of 90 flathead catfish for a mean catch rate of 36.0 fish/h (Table 17). The higher daily catch rate, 42.9 fish/h, occurred on June 11, at a surface water temperature of 23C (Table 18). Four repeat captures were made on June 18 of flathead catfish previously sampled on June 11.

Flathead catfish PSD for the 2002 sample was 18, lowest of the five-year period (Table 17). Relative weights in 2002 rebounded from a five-year low for stock-quality length fish in 2001, but were among the lowest of the five-year period for quality-preferred length fish. No preferred-length fish was captured in 2002, similar to the previous four years. Flathead catfish total length ranged from 72 mm to 565 mm (Figure 7). Nine year-classes of flathead catfish were present in the 2002 samples (Table 19). Total length-weight regression equations are provided in Appendix 3.

Growth incerements for most ages of flathead catfish during 2001 were similar to previous years. (Table 20). Mean total lengths reached by flathead catfish in Lewis and Clark Lake, as determined by back-calculation, are presented in Table 21. Mean total lengths for age-3 through age-5 fish are less than that attained by flathead catfish in the lower Mississippi River (Mayo and Schramm 1999).

Flathead catfish annual survival estimated from catch curve analysis (Ricker 1975) of 2001-2002 pooled catch data was 55%, with an $r^2$ value of 0.93. Catch numbers of age-3 and older fish were utilized for survival estimation because flathead catfish in Lewis and Clark Lake apparently were not fully susceptible to electrofishing until age-3. Annual survival estimated for 2000-2001 pooled catch data was 53%, with an $r^2$ value of 0.89, when using age-3 and older fish numbers for the calculations. Estimated annual survival for age-1 and older fish for 2000-2001 pooled data was 71%, with an $r^2$ value of 0.40 (Wickstrom 2002).

Table 17. Catch per unit effort (CPUE), proportional stock density, relative stock density for preferred and memorable length fish (RSD-P, RSD-M), and relative weights (standard error) of stock-quality (S-Q), quality-preferred (Q-P), and preferred-length (P) flathead catfish collected by electrofishing Lewis and Clark Lake. N is the number of stock-length fish sampled.

| *Year* | CPUE fish/h | | SD-P | RSD-M | Relative weight | | | N |
|---|---|---|---|---|---|---|---|---|
| 1998 | 7.6 2.2 | | | | 95 4.3 | 102 5.2 | - | 13 |
| 1999 | 21.4 5.3 | | | | 89 2.0 | 95 1.9 | - | 26 |
| 2000 | 18.2 3.6 | | | | 93 0.8 | 91 0.0 | - | 21 |
| 2001 | 28.0 9.8 | | | | 85 1.0 | 882.0 | - | 25 |
| 2002 | 36.0 9.3 | | | | 91 0.7 | 88 1.5 | - | 48 |

Table 18. Catch statistics for flathead catfish collected by electrofishing Lewis and Clark Lake during June 2002. Standard errors are in parenthesis.

| Date | Fish/h | Mean length (mm) | Water temperature |
|---|---|---|---|
| June 11 | 42.0(13.5) | 294 | 23 C |
| June 18 | 30.0(14.1) | 268 | 21 C |
| Mean | 36.0(9.3) | 282 | - |

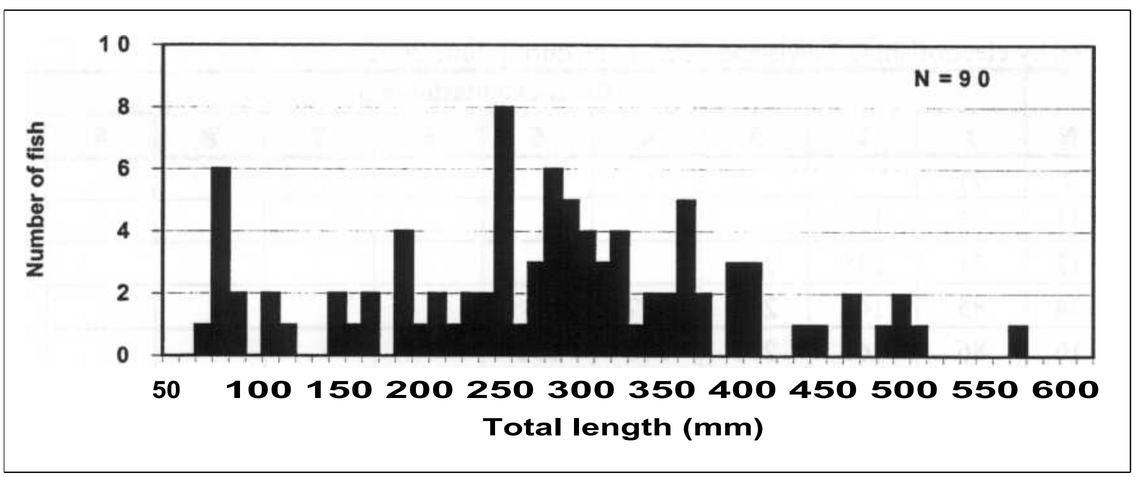


Figure 7. Length frequency of flathead catfish collected by electrofishing Lewis and Clark Lake during June 2002. N is the sample size.

Table 19. Age distribution of flathead catfish collected by electrofishing Lewis and Clark Lake during 2000-2002.

| Year class | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean |
| 2000 | 0 | 0 | 16 | 9 | 8 | 0 | 0 | 1 | 0 | 0 | 3.9 |
| 2001 | 0 | 3 | 23 | 24 | 5 | 9 | 2 | 0 | 2 | 0 | 4.1 |
| 2002 | 7 | 11 | 12 | 34 | 16 | 1 | 5 | 2 | 0 | 1 | 3.9 |

Table 20. Mean annual growth increments (mm) of back-calculated total lengths for each year-class of flathead catfish collected b electrofishing Lewis and Clark Lake during June 2002.

| Year class | Age | N | Growth period (ages) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 6-7 | 7-8 | 8-9 | 9-10 |
| 2001 | 1 | 7 | 71 | | | | | | | | | |
| 2000 | 2 | 11 | 75 | 77 | | | | | | | | |
| 1999 | 3 | 12 | 71 | 64 | 80 | | | | | | | |
| 1998 | 4 | 34 | 85 | 62 | 57 | 73 | | | | | | |
| 1997 | 5 | 16 | 86 | 75 | 75 | 64 | 51 | | | | | |
| 1996 | 6 | 1 | 78 | 81 | 33 | 65 | 64 | 49 | | | | |
| 1995 | 7 | 5 | 85 | 78 | 103 | 71 | 56 | 31 | 36 | | | |
| 1994 | 8 | 2 | 118 | 87 | 69 | 56 | 63 | 50 | 49 | 21 | | |
| 1992 | 10 | 1 | 84 | 82 | 108 | 68 | 54 | 14 | 27 | 27 | 14 | 13 |
| Population mean | | | 84 | 76 | 75 | 66 | 57 | 36 | 37 | 24 | 14 | 13 |
| Sample size | | 89 | 89 | 82 | 71 | 59 | 25 | 9 | 8 | 3 | 1 | 1 |

Table 21. Mean back-calculated total lengths (mm) at annulus for each year-class of flathead catfish collected b electrofishing Lewis and Clark Lake during June 2002.

| Year class | Age | N | Back-calculation age | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2001 | 1 | 7 | 71 | | | | | | | | | |
| 2000 | 2 | 11 | 75 | 152 | | | | | | | | |
| 1999 | 3 | 12 | 71 | 135 | 215 | | | | | | | |
| 1998 | 4 | 34 | 85 | 147 | 204 | 277 | | | | | | |
| 1997 | 5 | 16 | 86 | 161 | 236 | 300 | 351 | | | | | |
| 1996 | 6 | 1 | 78 | 159 | 192 | 224 | 288 | 337 | | | | |
| 1995 | 7 | 5 | 85 | 163 | 266 | 337 | 393 | 424 | 460 | | | |
| 1994 | 8 | 2 | 118 | 205 | 274 | 330 | 393 | 443 | 492 | 513 | | |
| 1992 | 10 | 1 | 84 | 166 | 274 | 342 | 396 | 410 | 437 | 464 | 478 | 491 |
| Population mean | | | 84 | 161 | 237 | 302 | 364 | 403 | 463 | 489 | 478 | 491 |
| Sample size | | 89 | 89 | 82 | 71 | 59 | 25 | 9 | 8 | 3 | 1 | 1 |

MISSOURI RIVER-ELECTROFISHING

## Ft. Randall Tailwater Smallmouth Bass

Fall electrofishing the Missouri River below Ft. Randall Dam during 2002 produced a CPUE value of 91 smallmouth bass/h, the highest catch rate of previous years (Table 22). However, only 19 stock-length fish were sampled, which was the lowest of the five-year period. The PSD of 58 declined from 2001, but was the second highest of previous years. A memorable-length fish was sampled for the first time in recent years. Relative weights were not unlike previous years.

Growth increments of smallmouth bass in Ft. Randall tailwater during 2001 were generally lower than previous years (Table 23). Mean total length at age for all year-classes, as determined by back-calculation, are presented in Table 24. Population mean total lengths for age-2 and older fish were greater than means for statewide South Dakota waters (Willis et al. 2001). Smallmouth bass sampled in 2002 ranged in length from 66 nun to 434 mm (Figure 8). A large year-class of smallmouth bass was produced in 2002. Mean age increased to 2.3 years during 2002 (Table 25). Total length-weight regression equations for smallmouth bass in Ft. Randall tailwater are provided in Appendix 3.

Annual survival estimated by catch curve analysis (Ricker 1975) for 2001-2002 pooled data, excluding age-0 fish, was 66%, with an associated $r^2$ value of 0.71. Estimated annual survival for 2000-2001 pooled data, excluding age-0 fish, was 52% (Wickstrom 2002).

Table 22. Catch per unit effort (CPUE), proportional stock density (PSD), relative stock density for preferred and memorable-length fish (RSD-P, RSD-M), and relative weight (standard error) of stock-quality (S-Q), quality-preferred (Q-P), and preferred-length (P) smallmouth bass collected by electrofishing the Missouri River below Ft. Randall Dam. N is the of stock-len th fish sampled.

| Year | CPUE (fish/h) | PSD | RSD-P | RSD-M | Relative weight ht | | | N |
|---|---|---|---|---|---|---|---|---|
| 1997 | 41.5 29.5 | | | | 108 1.8 | 1081.5 | 104 7.8 | 80 |
| 1999 | | | | | 1041.7 | 1002.6 | 1012.1 | 36 |
| 2000 | 66.0 14.0 | | | | 107 1.8 | 102 0.5 | - | 25 |
| 2001 | 30.0 4.6 | | | | | 105 1.4 | 101 4.5 | 22 |
| 2002 | 91.0 21.7 | | | | 106 2.3 | 992.6 | 93 2.6 | 19 |

Table 23. Mean annual growth increments (mm) from back-calculated total lengths for each year-class of smallmouth bass collected by electrofishing the Missouri River below Ft Randall Dam during October 2002.

| **Year** | | | **Growth period (ages)** | | | | | |
|---|---|---|---|---|---|---|---|---|
| **class** | **Age** | **N** | **0-1** | **1-2** | **2-3** | **3-4** | **4-5** | **5-6** |
| 2001 | 1 | 12 | 82 | | | | | |
| 2000 | 2 | 5 | 95 | 83 | | | | |
| 1999 | 3 | 2 | 80 | 109 | 86 | | | |
| 1998 | 4 | 5 | 83 | 100 | 93 | 52 | | |
| 1996 | 6 | 2 | 102 | 109 | 93 | 79 | 22 | 9 |
| Population mean | | | 88 | 100 | 91 | 66 | 22 | 9 |
| Sample size | | 26 | 26 | 14 | 9 | 7 | 2 | 2 |

Table 24. Mean back-calculated total lengths (mm) at annulus for each year-class of smallmouth bass collected by electrofishing the Missouri River below Ft Randall Dam during October 2002.

| **Year** | | | **Back-calculation age** | | | | | |
|---|---|---|---|---|---|---|---|---|
| **class** | **Age** | **N** | | **2** | **3** | **4** | **5** | **6** |
| 2001 | 1 | 12 | 82 | | | | | |
| 2000 | 2 | 5 | 95 | 178 | | | | |
| 1999 | 3 | 2 | 80 | 189 | 275 | | | |
| 1998 | 4 | 5 | 83 | 183 | 276 | 328 | | |
| 1996 | 6 | 2 | 102 | 211 | 304 | 383 | 405 | 414 |
| Population mean | | | 89 | 190 | 285 | 356 | 405 | 414 |
| Sample size | | 26 | 26 | 14 | 9 | 7 | 2 | 2 |

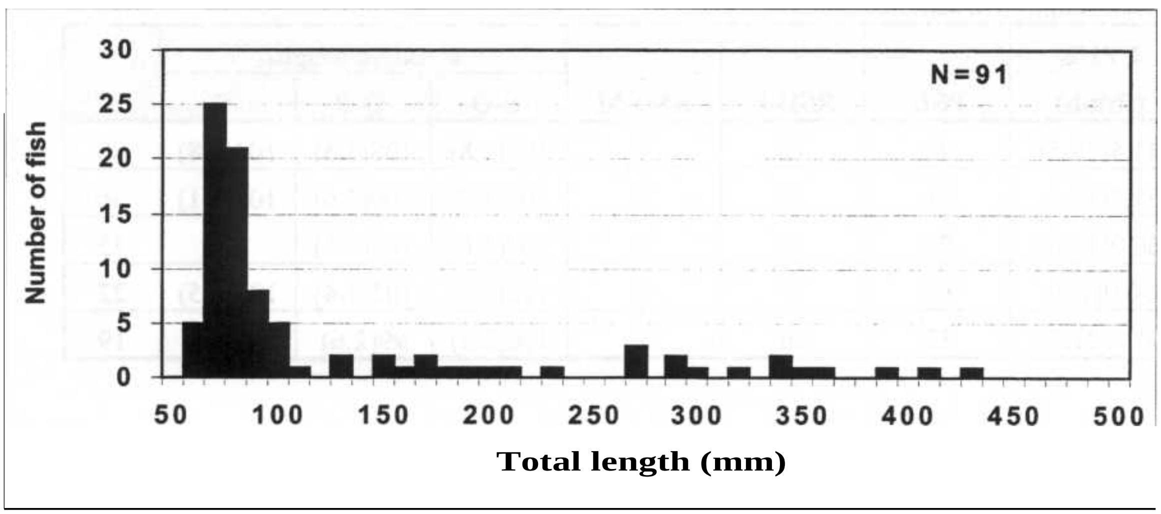


Figure 8. Length frequency of smallmouth bass sampled by electrofishing the Missouri River below Ft. Randall Dam, October 2002. N is the sample size.

Table 25. Age distribution of smallmouth bass collected by electrofishing the Missouri River below Ft. Randall Dam, 1999-2002. Mean a e excludes a e-0 fish.

| **Year** | | | | **Age** | | | | |
|---|---|---|---|---|---|---|---|---|
| **class** | **0** | | **2** | **3** | 4 | **5** | **6** | **Mean** |
| **1999** | 44 | 20 | 10 | 5 | 3 | 1 | 0 | 1.8 |
| **2000** | 34 | 17 | 9 | 0 | 0 | 0 | 0 | 1.3 |
| **2001** | 4 | 8 | 10 | 2 | 6 | 0 | 0 | 2.2 |
| **2002** | 65 | 12 | 5 | 2 | 5 | 0 | 2 | 2.3 |

## Gavins Point Tailwater Smallmouth Bass

Spring electrofishing in the Missouri River below Gavins Point Dam during 2002 produced a sample of 35 smallmouth bass for a catch rate of 52.5 fish/h (Table 26). PSD was zero because no fish longer then stock-quality length was sampled. The PSD continues to be extremely low for a fish population (Anderson and Weithman 1978). Mean relative weight at 96 was lower than 2001, but in the range of previous years.

Smallmouth bass growth increments in Gavins Point tailwater during 2001 were greater than previous years (Table 27). Total lengths attained during 2001, as determined by back-calculation, are presented in Table 28. Population mean total lengths for age-1 and age-2 fish were greater than means for statewide South Dakota waters, but less for age-3 fish (Willis et al. 2001). Mean age decreased to 1.7 years in 2002 (Table 29). Smallmouth bass sampled in 2002 ranged in length from 81 mm to 270 mm (Figure 11). Total length-weight regression equation for smallmouth bass in Gavins Point tailwater is provided in Appendix 3.

Annual survival estimated by catch curve analysis (Ricker 1975) for 2001-2002 pooled data, using age-2 and older fish numbers, was 29% with an associated $r^2$ value of 0.92. Annual survival reported for 2000-2001 pooled data, for age-1 and older fish, was 49%, with an $r^2$ value of 0.58 (Wickstrom 2002). However, annual survival calculated for 2000-2001 pooled data, using age-2 and older fish numbers, was 26%, with an $r^2$ value of 0.90. Apparently age-1 smallmouth bass were not fully susceptible to electrofishing and were not sampled in relation to their abundance in the population. This caused the estimate of annual survival for 2000-2001 data, using age-1 and older fish numbers, to be overstated when compared to estimated annual survival for 2000-2001 data, using age-2 and older fish numbers.

Table 26. Catch per unit effort (CPUE), proportional stock density (PSD), relative stock density for preferred and memorable-length fish (RSD-P, RSD-M), and relative weight (standard error) of stock-quality (S-Q), quality-preferred (Q-P), and preferred-length (P) smallmouth bass collected by electrofishing the Missouri River below Gavins Point Dam. N is the number of stock-len th fish sampled.

| Year | CPUE (fish/h) | PSD | RSD-P | RSD-M | Relative weight S-O | Q-P | P | N |
|---|---|---|---|---|---|---|---|---|
| 1997 | 78.5(23.0) | 3 | 0 | 0 | * | * | * | 37 |
| 2000 | 22.0(2.0) | | 0 | 0 | 91(1.0) | 94(0.0) | - | 18 |
| 2001 | 44.0(13.2) | | 4 | 0 | 105(1.0) | - | 102(0.0) | 28 |
| 2002 | 52.5(31.5) | 0 | 0 | 0 | 96(1.1) | - | - | 16 |

* not available

Table 27. Mean annual growth increments (mm) of back-calculated total lengths for each year-class of smallmouth bass collected by electrofishing the Missouri River below Gavins Point Dam during Ma 2002.

| Year class | Age | N | Growth period (ages) 0-1 | 1-2 | 2-3 |
|---|---|---|---|---|---|
| 2001 | 1 | 13 | 116 | | |
| 2000 | 2 | 18 | 98 | 97 | |
| 1999 | 3 | 4 | 94 | 87 | 46 |
| Population mean | | | 103 | 82 | 46 |
| Sample size | | 34 | 34 | 22 | 4 |

Table 28. Mean back-calculated total lengths (mm) at annulus for each year-class of smallmouth bass collected by electrofishing the Missouri River below Gavins Point D Ma 2002.

| Year class | Age | N | Back-calculation age 1 | 2 | 3 |
|---|---|---|---|---|---|
| 2001 | 1 | 13 | 116 | | |
| 2000 | 2 | 18 | 98 | 195 | |
| 1999 | 3 | 4 | 94 | 181 | 227 |
| Population mean | | | 103 | 188 | 227 |
| Sample size | | 34 | 34 | 22 | 4 |

Table 29. Age distribution of smallmouth bass collected by electrofishing the Missouri River below Gavins Point Dam, 2000-2002.

| Year class | Age 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| 2000 | 4 | 8 | 9 | 1 | 0 | 2.3 |
| 2001 | 11 | 31 | 1 | 0 | 1 | 1.8 |
| 2002 | 13 | 18 | 4 | 0 | 0 | 1.7 |

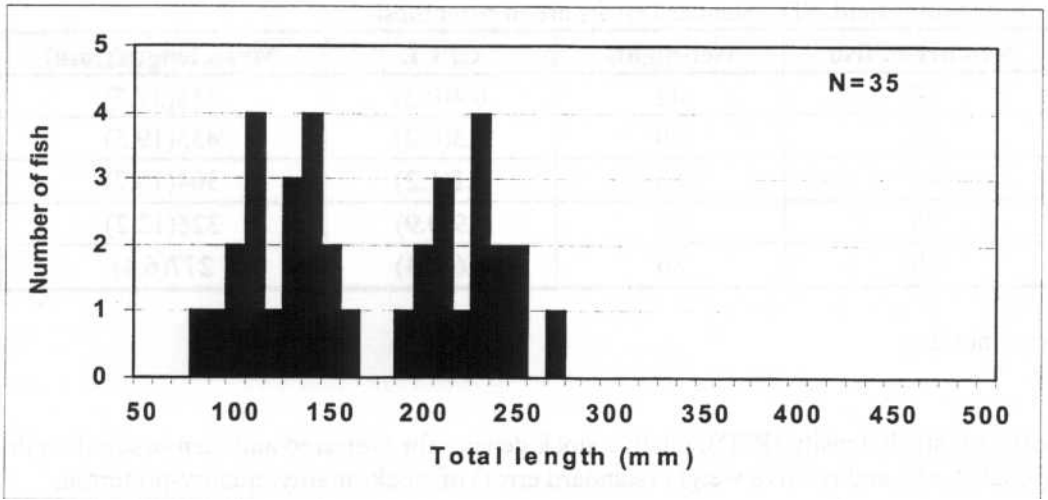

Figure 9. Length frequency of smallmouth bass sampled by electrofishing the Missouri River below Gavins Point Dam, May 2002. N is the sample size.

MISSOURI RIVER-HOOP NETS

Channel Catfish Population Parameters

Cheese-baited hoop nets sampled 140 channel catfish in the Missouri River near Springfield, SD during 2002 (Table 30). No repeat capture of a previously marked fish occurred. Total mean catch rate of 1.6 fish/net-night was the highest since the survey was initiated in 1995 (Wickstrom 1998). Mean total length of channel catfish captured in 2002 was lower than any previous year but 2000. Channel catfish PSD at 22 in 2002 was also the lowest of any previous year (Table 31). Relative weights for 2002 were the lowest recorded for stock-quality and preferred-length fish. Lengths of channel catfish sampled in 2002 ranged from 194 mm to 632 mm (Figure 10).

Growth increments of channel catfish in the Missouri River during 2001 were similar to previous years (Table 32). Mean total length at age, as determined by back-calculation, for each year-class sampled are presented in Table 33. Population mean total lengths at each age were less than for channel catfish sampled in Lewis and Clark Lake with gill nets in September 2001, the most recent year age and growth analysis was done on channel catfish in the reservoir (Wickstrom 2002). Mean age of channel catfish sampled during 2002 was 3.2 years (Table 34).

Annual survival estimated by catch curve analysis (Ricker 1975) for channel catfish in the Missouri River for 2002 data, for age-2 and older fish, was 64% with an associated $r^2$ value of 0.80. By comparison, estimated annual survival for 2001-2002 pooled data, for age-2 and older fish, was 64% with an $r^2$ value of 0.91. Annual survival estimated for 2000-2002 pooled data, for age-2 and older fish, was 62%, with an $r^2$ value of 0.94.

Table 30. Annual mean hoop net catches (CPUE) of channel catfish from the Missouri River near Springfield, SD. Standard errors are in parenthesis.

| Year | Number of fish | Net-nights | CPUE | Mean length (mm) |
|---|---|---|---|---|
| 1998* | 18 | 42 | 0.4(0.2) | 338(37.7) |
| 1999** | 24 | 80 | 0.3(0.2) | 435(19.5) |
| 2000** | 99 | 88 | 1.1(1.2) | 304(10.7) |
| 2001** | 76 | 88 | 0.9(0.9) | 326(12.2) |
| 2002** | 140 | 86 | 1.6(1.4) | 277(6.4) |

* nets run daily

* * nets run every other day

Table 31. Proportional stock density (PSD), relative stock density for preferred and memorable-length fish (RSD-P, M), and relative weight (standard error) of stock-quality, quality-preferred, and preferred-length channel catfish collected with hoop nets from the Missouri River near Springfield, SD. N is the number of stock-length fish sampled.

| | | Relative weight | | | |
|---|---|---|---|---|---|
| Year | PSD(RSD-P, M) | Stock-quality | Quality-Preferred | Preferred | N |
| 1998 | 56 (22,0) | 105(10.7) | 89(4.6) | 98(7.3) | 9 |
| 1999 | 74 (21,5) | 89(4.7) | 84(2.8) | 92(2.6) | 19 |
| 2000 | 24(8,0) | 84(1.1) | 84(0.9) | 85(6.4) | 40 |
| 2001 | 27(7,2) | 91(0.6) | 90(4.9) | 97(1.2) | 44 |
| 2002 | 22(2,0) | 84(0.8) | 79(2.8) | 68(0.0) | 46 |

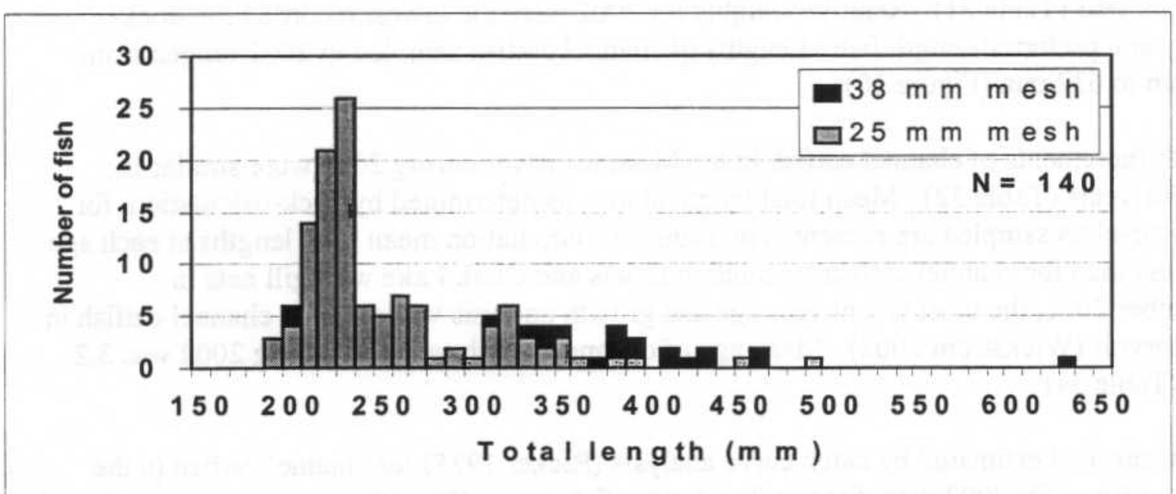


Figure 10. Length frequency of channel catfish, collected with baited hoop nets, from the Missouri River near Springfield, SD during August 2002. N is the sample size.

Table 32. Mean annual growth increments (mm) of back-calculated total lengths for each year-class of channel catfish collected with hoop nets from the Missouri River near Springfield, SD during August 2002.

| **Year class** | **Age** | **N** | **Growth period (ages)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **0-1** | **1-2** | **2-3** | **3-4** | **4-5** | **5-6** | **6-7** | **7-8** | **8-9** | **9-10** | **10-11** | **11-12** |
| 2000 | 2 | 72 | 70 | 85 | | | | | | | | | | |
| 1999 | 3 | 19 | 72 | 42 | 76 | | | | | | | | | |
| 1998 | 4 | 25 | 75 | 48 | 77 | 77 | | | | | | | | |
| 1997 | 5 | 16 | 76 | 49 | 83 | 54 | 62 | | | | | | | |
| 1996 | 6 | 3 | 72 | 81 | 78 | 77 | 33 | 38 | | | | | | |
| 1995 | 7 | 1 | 81 | 33 | 78 | 41 | 67 | 51 | 44 | | | | | |
| 1994 | 8 | 1 | 76 | 15 | 62 | 37 | 86 | 46 | 46 | 46 | | | | |
| 1992 | 10 | 1 | 79 | 42 | 121 | 42 | 39 | 32 | 26 | 23 | 16 | 17 | | |
| 1991 | 11 | 1 | 102 | 89 | 107 | 54 | 18 | 25 | 11 | 17 | 18 | 18 | 18 | |
| 1990 | 12 | 1 | 69 | 39 | 97 | 197 | 77 | 8 | 8 | 12 | 38 | 39 | 51 | 8 |
| Population mean | | | 78 | 52 | 87 | 72 | 55 | 33 | 27 | 25 | 24 | 25 | 35 | 8 |
| Sample size | | | 140 | 140 | 68 | 49 | 24 | | | 4 | 3 | 3 | | 1 |

Table 33. Mean back-calculated total lengths (mm) at annulus for each year-class of channel catfish collected with hoop nets from the Missouri River near Springfield SD during August 2002.

| **Year class** | **Age** | **N** | **Back-calculation age** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **2** | | | **5** | | | | | **10** | **11** | **12** |
| 2000 | 2 | 72 | 70 | 155 | | | | | | | | | | |
| 1999 | 3 | 19 | 72 | 114 | 190 | | | | | | | | | |
| 1998 | 4 | 25 | 75 | 123 | 200 | 277 | | | | | | | | |
| 1997 | 5 | 16 | 76 | 125 | 208 | 262 | 324 | | | | | | | |
| 1996 | 6 | 3 | 72 | 153 | 231 | 308 | 341 | 379 | | | | | | |
| 1995 | 7 | 1 | 81 | 114 | 192 | 233 | 300 | 351 | 395 | | | | | |
| 1994 | 8 | 1 | 76 | 91 | 153 | 190 | 276 | 322 | 368 | 414 | | | | |
| 1992 | 10 | 1 | 79 | 121 | 242 | 284 | 323 | 355 | 381 | 404 | 420 | 437 | | |
| 1991 | 11 | 1 | 102 | 191 | 298 | 352 | 370 | 395 | 406 | 423 | 441 | 459 | 477 | |
| 1990 | 12 | 1 | 69 | 108 | 205 | 372 | 449 | 457 | 465 | 477 | 515 | 554 | 605 | 613 |
| Population mean | | | 77 | 130 | 213 | 285 | 340 | 377 | 403 | 430 | 459 | 483 | 541 | 613 |
| Sample size | | | 140 | 140 | 68 | 49 | 24 | 8 | 5 | 4 | | 3 | 2 | 1 |

Table 34. Age distribution of channel catfish collected in hoop nets from the Missouri River near Springfield, SD 2000-2002.

| Year | Age | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Mean |
| 2000 | 0 | 48 | 20 | 6 | 14 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2.9 |
| 2001 | 1 | 3 | 29 | 16 | 10 | 7 | 4 | 2 | 1 | 2 | 0 | 0 | 1 | 4.4 |
| 2002 | 0 | 72 | 19 | 25 | 16 | 3 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 3.2 |

MSSOURI RIVER-SEINES

Fourteen species of age-0 and small littoral fishes were collected with seines near Springfield, SD during July 2002 (Table 35). All species sampled have been previously reported from Lewis and Clark Lake (Wickstrom 2002). Age-0 largemouth bass was the most abundant fish species sampled with seines in 2002, followed by emerald shiner, Johnny darter, and smallmouth bass. Emerald shiner, spotfin shiner, and largemouth bass have been sampled all years. Black crappie was sampled after a two-year absence and white bass after a four absence from this survey. Yellow perch was not sampled during 2002 for the first time since 1995 (Wickstrom 1996).

Table 35. Mean catch per seine haul, sampling stations combined, of age-0 fishes and small littoral species from the Missouri River near Spring field, SD, 1998-2002 (standard error .

| Species | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|
| Bigmouth buffalo | 0.0 | 0.0 | 0.0 | 0.3(0.1) | 0.0 |
| Black crappie | 0.0 | 0.2(0.1) | 0.0 | 0.0 | 0.2(0.2) |
| Bluegill | 0.2(0.1) | 0.1(0.1) | 0.0 | 0.0 | t |
| Bluntnose minnow* | 0.0 | 0.1(0.1) | 0.0 | t | 0.0 |
| Emerald shiner* | 9.1(7.4) | 2.2(1.0) | 0.4(0.2) | 2.2(0.8) | 0.6(0.6) |
| Common carp | 0.1(0.1) | 0.0 | 0.0 | 0.2(0.1) | 0.1(0.1) |
| Hybognathus sp.* | 0.0 | 0.0 | 0.0 | 0.0 | t |
| Johnny darter* | 0.0 | 0.1(0.1) | 0.3(0.2) | 0.3(0.2) | 0.6(0.4) |
| Largemouth bass | 2.2(0.8) | 0.8(0.3) | 1.7(0.8) | 2.0(0.8) | 1.6(0.6) |
| Northern pike | 0.0 | 0.0 | 0.1(0.1) | 0.0 | 0.0 |
| Red shiner* | 0.7(0.5) | t | 0.0 | t | 0.0 |
| River carpsucker | 0.5(0.3) | 0.1(0.1) | 17.4(13.5) | 0.1(0.1) | 0.4(0.2) |
| Sauger | 0.1(0.1) | 0.0 | 0.0 | 0.1(0.1) | 0.2(0.2) |
| Shorthead redhorse | 0.0 | 0.0 | 0.0 | 0.2(0.1) | 0.0 |
| Smallmouth bass | 0.0 | t | 0.9(0.4) | 0.2(0.1) | 0.6(0.2) |
| Smallmouth buffalo | 0.1(0.1) | 0.2(0.2) | 0.0 | 1.1(0.8) | 0.0 |
| Spotfin shiner* | 2.7(1.3) | 0.9(0.6) | 1.4(1.3) | 1.0(0.9) | 0.2(0.2) |
| Spottail shiner* | 0.6(0.5) | 0.0 | 0.0 | 0.5(0.2) | 0.0 |
| Walleye | 0.3(0.1) | 0.5(0.2) | 0.2(0.1) | t | 0.1(0.1) |
| White bass | 0.1(0.1) | 0.0 | 0.0 | 0.0 | t |
| White crappie | 0.6(0.4) | 0.0 | 0.1(0.1) | 0.1(0.1) | 0.2(0.1) |
| Yellow perch | 2.3(0.8) | 0.1(0.1) | 0.7(0.4) | 2.9(1.4) | 0.0 |

t=trace (<0.1)

* includes both adults and age-0 fish

RARE FISH OBSERVATIONS

One paddlefish and one pallid sturgeon were sampled in Lewis and Clark Lake during 2002. Paddlefish is a native species of concern whose status is questioned due to suspected problems with abundance or distribution (Dakota Chapter of the American Fisheries Society 1994). Pallid sturgeon is an endangered native species whose survival is jeopardized because their numbers are declining from human activities and they are dependent on unique and limited habitat that has declined.

## CONCLUSIONS

Effects of below average runoff in the Missouri River basin during 2002 (U. S. Corps of Engineers, unpublished data) were evident in most fish populations in Lewis and Clark Lake. Overall abundance of prey fish species was much reduced from 2001 levels. Emerald shiner, spottail shiner, spotfin shiner, red shiner, creek chub, age-0 freshwater drum, age-0 yellow perch, and age-0 white bass abundance decreased and was possibly related to reduced nutrient inflow or environmental factors. Correspondingly, condition of nearly all piscivorous fishes in Lewis and Clark Lake decreased from 2001 levels. Walleye, sauger, smallmouth bass, and flathead catfish had lower relative weights during 2002.

Walleye and sauger populations in Lewis and Clark Lake are maturing after producing large year-classes in 2001. Size structure indices (P SD) of both species reflect the inclusion of numerous small individuals into the populations. At current growth rates, the large 2001 walleye and sauger year-classes should be entering the fishery by late summer of 2004. Apparently the 381 mm minimum length limit is having the desired effect of reducing harvest of small fish and lengthening the time walleyes and saugers spend in the fishery. In 2002, there were more walleye and sauger longer than 381 mm than in 2000, but less than in 2001. A build up of fish below 381 mm has not happened. Recent growth for both species was higher than the population means at each age and *Wr's* were adequate in 2002. Occurrence of the stock piling effect will be tested in the near future when individuals in the large 2001 year-classes approach 381 mm.

A vast improvement in the size structure of smallmouth bass in Lewis and Clark Lake near Gavins Point Dam was observed in 2002. More large fish were sampled there than during any previous year. Optimal sampling conditions and timing could have contributed to collection of large fish previously unseen near Gavins Point Dam. Also, low harvest of smallmouth bass from Lewis and Clark Lake (Mestl et al. 2001; Wickstrom 2002) could have allowed more, older individuals to remain in the population.

The smallmouth bass population in Gavins Point Dam tailwater continues to be comprised of small fish. This population has consistently had an extremely low PSD since it was first evaluated in 1997. Growth of age-2 and older fish (Wickstrom 2002) is low compared to Lewis and Clark Lake and is probably caused by a shortage of food items. High harvest of smallmouth bass in 2001 (Wickstrom et al. 2002) and extremely high harvest in 2000 (Mestl et al. 2001) could also be a factor in the predominance of small fish. Wickstrom et al. (2002) reported a mean length of 347 mm for smallmouth bass harvested from Gavins Point Dam tailwater in 2001, which substantiates the harvest of large fish. Furthermore, the low annual survival rate confirms that older, larger individuals are, in some way, rapidly lost from this population.

Growth rates for channel catfish in Lewis and Clark Lake (Wickstrom 2002) and the Missouri River near Springfield, SD are extremely slow. These slow growth rates are reflected in the size structure of the population, which usually includes no or very few memorable-length fish. At current growth rates fish that are 12 years old, on average, do not attain memorable-length status. It is entirely possible that channel catfish in Lewis and Clark Lake and Missouri River upstream will never reach the trophy-length category.

Flathead catfish seem secure in Lewis and Clark Lake. Although PSD has decreased the past few years, CPUE has continually increased. Flathead catfish are difficult to collect even when under the influence of an electrical field (Cunningham 1998). Field personnel ought to become more proficient sampling flathead catfish, and with years of experience could contribute to an increase in CPUE. Additionally, results reported should be regarded as representative for that portion of the flathead catfish population <600 mm. Electrofishing is most effective capturing flathead catfish <600 mm (Stauffer et al. 1996). Flathead catfish >600 mm are able to resist effects of an electrical field and avoid capture.

Overall, the outlook for fishing opportunity and success at Lewis and Clark Lake remains good. Walleye and sauger populations are currently in good shape and the large 2001 year-classes of both species bode well for the future. Channel catfish abundance declined in 2002, but catchable sizes are still in good supply. Smallmouth bass near Gavins Point Dam have never been observed in better shape than they were in 2002.

## RECOMMENDATIONS

1. Continue annual fish population surveys on Lewis and Clark Lake. These surveys provide information on abundance, reproduction, recruitment, growth, condition, survival, mortality, and are essential for management purposes.

2. Collect hoop net samples of channel catfish in the transition zone and make comparisons to gill net samples of channel catfish in Lewis and Clark Lake.

3. Document population dynamics and age and growth of flathead catfish in order to evaluate management efforts of this species in Lewis and Clark Lake.

4. Assess smallmouth bass populations in Lewis and Clark Lake, in the Missouri River below Gavins Point Dam, below Ft. Randall Dam, and in the transition zone so management efforts can be evaluated.

5. Assess largemouth bass population in the transition zone and evaluate management efforts.

6. Periodically conduct creel surveys to assess angler resource use and fish harvest.

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Appendix 1

| Common Name | Scientific Name |
|---|---|
| Bigmouth buffalo | *Ictiobus cyprinellus* |
| Black crappie | *Pomoxis nigromaculatus* |
| Bluegill | *Lepomis macrochirus* |
| Bluntnose minnow | *Pimephales notatus* |
| Brassy minnow | *Hybognathus hankinsoni* |
| Channel catfish | *Ictalurus punctatus* |
| Common carp | *Cyprinus carpio* |
| Common shiner | *Notropis cornutus* |
| Creek chub | *Semotilus atromaculatus* |
| Emerald shiner | *Notropis atherinoides* |
| Fathead minnow | *Pimephales promelas* |
| Flathead catfish | *Pylodictus olivaris* |
| Freshwater drum | *Aplodinotus grunniens* |
| Gizzard shad | *Dorosoma cepedianum* |
| Goldeye | *Hiodon alosoides* |
| Golden shiner | *Notemigonus crysoleucas* |
| Grass pickerel | *Esox americanus vermiculatus* |
| Johnny darter | *Etheostoma nigrum* |
| Largemouth bass | *Micropterus salmoides* |
| Northern pike | *Esox lucius* |
| Rainbow smelt | *Osmerus mordax* |
| Red shiner | *Notropis lutrensis* |
| River carpsucker | *Carpiodes carpio* |
| Rock bass | *Ambloplites ruprestris* |
| Paddlefish | *Polyodon spathula* |
| Pallid sturgeon | *Scaphirhynchus albus* |
| Sauger | *Stizostedion canadense* |
| Shorthead redhorse | *Moxostoma macrolepidotum* |
| Shortnose gar | *Lepisosteus platostomus* |
| Silver chub | *Hybopsis storeriana* |
| Shortnose gar | *Lepisosteus platostomus* |
| Smallmouth bass | *Micropterus dolomieu* |
| Smallmouth buffalo | *Ictiobus bubalus* |
| Spotfin shiner | *Notropis spilopterus* |
| Spottail shiner | *Notropis hudsonius* |
| Walleye | *Stizostedion vitreum* |
| White bass | *Morone chrysops* |
| White crappie | *Pomoxis annularius* |
| Yellow perch | *Perca flavescens* |

Appendix 2. Standard weight equations used for relative weight calculations. Length is in millimeters, weight is in grams, and logarithms are to base 10.

| Species | Equation |
|---|---|
| Channel catfish | LogWS=3.2494LogTL-5.800 |
| Flathead catfish | LogWS=3.082LogTL-5.156 |
| Freshwater drum | LogWS=3.204LogTL-5.419 |
| Gizzard shad | LogWS=3.170LogTL-5.376 |
| River carpsucker | LogWs=2.992LogTL-4.839 |
| Sauger | LogWS=3.187LogTL-5.492 |
| Smallmouth bass | LogWS=3.200LogTL-5.329 |
| Walleye | LogWS=3.18OLogTL-5.453 |

Appendix 3. Total length (TL; mm) - weight (WT; g) regression equations, mean lengths, and mean weights of fishes sampled in this survey. Logarithms are to base 10. N is the sample size excluding age-0 fish. Mean (X) lengths and weights do not include age-0 fish. Standard errors are in parenthesis. GP is Gavins Point, TW is tailwater, and FR is Ft. Randall.

| **Species** | **Year** | **N** | **Equation** | **$R^2$** | **X TL** | **X WT** |
|---|---|---|---|---|---|---|
| Walleye | 1998 | 12 | Lo gWT=3.058LogTL-5.197 | 0.99 | 41630.4 | 763 148.1 |
| | 1999 | 40 | Lo gWT=3.126LogT1-5.388 | 0.99 | 360 13.5 | 47960.9 |
| | 2000 | 46 | Lo .WT=3.139LogTL-5.446 | 0.99 | 367 11.2 | 467 55.6 |
| | 2001 | 63 | Lo gWT=3.200LogTL-5.572 | 0.99 | 415 9.1 | 71046.0 |
| | 2002 | 76 | LogWT=3.267LogTL-5.770 | 0.99 | 367(14.2) | 465 36.1 |
| Sauger | 1998 | 48 | Lo .WT=3.128LogTL-5.443 | 0.99 | 393 8.7 | 50633.9 |
| | 1999 | 70 | Lo gWT=3.134LogTL-5.467 | 0.99 | 391 7.2 | 491 26.7 |
| | 2000 | 57 | Lo gWT=3.078LogTL-5.329 | 0.99 | 3729.4 | 428 32.9 |
| | 2001 | 85 | Lo gWT=3.053LogTL-5.231 | 0.99 | 401 7.0 | 56229.1 |
| | 2002 | 102 | LogWT=3.225LogTL-5.698 | 0.99 | 376 7.2 | 461 27.3 |
| C. catfish Gill nets | 1999 | 49 | Lo: Wt=3.317LogTL-5.926 | 0.99 | 391 17.1 | 671 111.9 |
| | 2000 | 47 | Lo_WT=3.211LogTL-5.643 | 0.99 | 430 16.6 | 819 103.1 |
| | 2001 | 55 | LogWT=3.226LogTL-5.682 | 0.99 | 418(14.1) | 746(92.5) |
| | 2002 | 38 | LogWT=3.310LogTL-5.912 | 0.99 | 423(18.4) | 778(107.0) |

Appendix 3 continued...

| | | | | | | |
|---|---|---|---|---|---|---|
| C. catfish Hoop | 1999 | 24 | LogWT=3.237LogTL-5.705 | 0.99 | 435(31.0) | 1012(216.0) |
| | 2000 | 99 | LogWT=3.077LogTL-5.306 | 0.99 | 304(10.1) | 324(52.1) |
| | 2001 | 75 | LogWT=3.194LogTL-5.581 | 0.99 | 326(12.2) | 416(74.3) |
| | 2002 | 140 | LogWT=2.913LogTL-4.907 | 0.98 | 277(6.4) | 200(18.1) |
| Flathead catfish | 1999 | 43 | LogWT=3.177LogTL-5.434 | 0.98 | 248(13.5) | 283(45.2) |
| | 2000 | 41 | LogWT=3.139LogTL-5.324 | 0.99 | 290(18.3) | 392(61.9) |
| | 2001 | 68 | LogWT=3.047LogTL-5.131 | 0.99 | 308(13.6) | 409(49.5) |
| | 2002 | 81 | LogWT=2.901LogTL-4.751 | 0.96 | 295(11.7) | 351(36.9) |
| Sm. bass GP Dam | 1999 | 67 | LogWT=2.937LogTL-4.748 | 0.97 | 233(5.7) | 181(13.9) |
| | 2000 | 21 | LogWT=3.188LogTL-5.327 | 0.99 | 249(18.3) | 285(65.3) |
| | 2001 | 59 | LogWT=2.930LogTL-4.728 | 0.99 | 225(6.5) | 168(15.5) |
| | 2002 | 75 | LogWT=3.137LogTL-5.223 | 0.98 | 276(7.9) | 337(35.5) |
| Sm. bass GPTW | 2000 | 22 | LogWT=3.196LogTL-5.360 | 0.99 | 221(12.5) | 167(26.4) |
| | 2001 | 42 | LogWT=2.975LogTL-4.782 | 0.98 | 192(7.5) | 124(17.1) |
| | 2002 | 35 | LogWT=3.035LogTL-4.958 | 0.99 | 174(9.4) | 92(13.3) |
| Sm. bass FRTW | 1999 | 35 | LogWT=3.083LogTL-5.038 | 0.99 | 249(9.9) | 271(34.7) |
| | 2000 | 26 | LogWT=3.091LogTL-5.044 | 0.96 | 248(7.4) | 245(22.9) |
| | 2001 | 30 | LogWT=3.065LogTL-4.969 | 0.99 | 253(14.7) | 322(45.2) |
| | 2002 | 26 | LogWT=3.005LogTL-4.851 | 0.99 | 262(17.9) | 355(64.3) |

Appendix 4. Proportional stock density (PSD), relative stock density of preferred and memorable-length fish (RSD-P and RSD-M), and mean relative weight (Wr) for freshwater drum, river carpsucker, and gizzard shad collected from Lewis and Clark Lake with gill nets during late summer. N is the number of stock length-fish sampled. Standard errors are in parenthesis.

| **Year** | **PSD** | **RSD-P** | **RSD-M** | **Wr** | **N** |
|---|---|---|---|---|---|
| Freshwater drum | | | | | |
| 2000 | 80 | 69 | 0 | 91(0.9) | 49 |
| 2001 | 95 | 95 | 0 | 95(0.8) | 21 |
| 2002 | 88 | 88 | 0 | 89(1.2) | 16 |
| **River carpsucker** | | | | | |
| 2000 | 100 | 80 | 10 | 88(1.0) | 20 |
| 2001 | 98 | 87 | 0 | 95(0.7) | 85 |
| 2002 | 95 | 95 | 5 | 88(1.2) | 19 |
| **Gizzard shad** | | | | | |
| 2000 | 100 | * | * | 105(0.2) | 68 |
| 2001 | 100 | * | * | 113(0.2) | 64 |
| 2002 | 31 | * | * | 99(2.7) | 13 |

* not established